

1 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

2 Applicants: James C. Chen, Darrin Huston, Attorney Docket No: CHEN0175
and Brian D. Wilkerson

3 Serial No: Group Art Unit:

4 Filed: Concurrently Herewith Examiner:

5 Title: CONTACTLESS ENERGY TRANSFER APPARATUS

6
7 PRELIMINARY AMENDMENT

8 Bellevue, Washington 98004

9 July 20, 2001

10 TO THE COMMISSIONER OF PATENTS AND TRADEMARKS:

11 Please amend the above-identified patent application, which is a divisional of U.S. patent
12 application Serial No. 09/547,700, as indicated below and in accordance with the attached
13 replacement sheets, and consider the application as thus amended in view of the Remarks that follow.
14 The attached replacement sheets 1, 27, 29, 30, 33, and 35 contain the amendments shown below.
15 Applicants requests that replacement sheets 1, 27, 29, 30, 33, and 35 be substituted for original
16 sheets 1, 27, 29, 30, 33, and 35 in this application.

17 AMENDMENT

18 In the Specification:

19 On page 1, line 3, after the words "This application is a" insert --divisional application, based
20 on prior copending application Serial No. 09/547,700, filed April 11, 2000, which in turn is a--.

21 In the Claims:

22 Please cancel Claims 16-20.

23 Please amend Claims 1, 5, 39, 40, and 50 as follows:

24 1. (Amended) A contactless electrical energy transfer apparatus comprising:

25 (a) a portable receiving unit including:

26 (i) a receiver coil; and

1 (ii) a housing in which the receiver coil is disposed, said housing
2 supporting the receiver coil; and

3 (b) a flux generator including:

4 (i) a housing adapted to be disposed proximate to the housing of the
5 receiving unit;

6 (ii) a magnetic field generator comprising at least one permanent magnet
7 disposed within the housing of the flux generator; and

8 (iii) a prime mover drivingly coupled to an element of the magnetic field
9 generator, causing said element of the magnetic field generator to move relative to the receiver coil,
10 movement of said element of the magnetic field generator producing a varying magnetic field that is
11 coupled to [the] a core of the receiver coil, inducing an electrical current to flow in the receiver coil.

12 5. (Amended) The energy transfer apparatus of Claim 1, wherein the prime mover is
13 disposed outside the housing of the [magnetic field] flux generator and is drivingly coupled to said
14 element of the magnetic field generator through a driven shaft.

15 39. (Amended) The method of Claim 33, further comprising the step of [enhancing]
16 directing magnetic flux lines through a magnetic flux linkage between magnetic poles of the
17 permanent magnet and the receiver coil.

18 40. (Amended) The method of Claim 39, wherein the step of [enhancing] directing magnetic
19 flux lines through the magnetic flux linkage comprises the step of providing a flux linkage bar for
20 coupling a magnetic field from a pole of the permanent magnet into the receiver coil.

21 50. (Amended) The method of Claim 41, wherein said element is moved sufficiently fast to
22 magnetically couple energy into the receiver coil, which is an air core receiver coil.

23 REMARKS

24 Claims 1-15 and 21-55 are now pending in the present application. Claims 1, 5, 39, 40,
25 and 50 have been amended to more clearly define the invention. Claims 16-20 have been cancelled
26 by applicants in the present amendment.

1 Claims Rejected under 35 U.S.C. § 103(a) over Shirai in view of Summers in Parent Application

2 The present application is a divisional application, claiming priority in U.S. Patent
3 Application Serial Number 09/547,700. In the '700 application, the Examiner rejected numerous
4 claims as being unpatentable over Shirai et al. (U.S. Patent No. 5,550,452, hereinafter "Shirai") in
5 view of Summers (U.S. Patent No. 3,672,352, hereinafter "Summers").

6 The Examiner indicates that "Shirai teaches a contactless induction charging apparatus
7 having: a portable receiving unit 18 including a receiver or secondary coil 16 and a housing 24
8 therefor; and a flux generator or power source 12 comprising a housing 22 adapted to be disposed
9 proximate the receiver unit 18." The Examiner further indicates that "Shirai differs in that the flux
10 generator 12 does not comprise a magnet moved by a prime mover and coupled with the receiver coil
11 16 to generate current flow therein. Rather, Shirai has a primary coil 14 in the power source 12
12 which inductively couples with the secondary coil 16 and generates current therein by
13 electromagnetic induction." The Examiner relies on Summers as teaching "an implantable means of
14 contactless, inductive energy transfer including a magnetic field generator comprising a magnet 32
15 (Fig. 9) rotatably driven by a prime mover (not shown) to induce current within an implanted,
16 contactless secondary coil 34." The Examiner concludes that it would have been obvious to one
17 having ordinary skill in the art at the time of the invention to modify Shirai and provide a driven
18 magnet per Summers for the flux generator, for the purpose of inducing current within a contactless
19 secondary coil.

20 During prosecution of the parent '700 application, applicants indicated that the combination
21 of Shirai and Summers, as suggested by the Examiner, is not a proper combination of prior art
22 references. For the following reasons, the combination of Shirai and Summers should not be applied
23 to reject the claims of the present application. In the discussion that follows, the term "rotating
24 magnet" is intended to encompass other embodiments of applicants' invention as defined in their
25 claims, such as a moving element (e.g., a flux linkage bar) that changes a magnetic flux directed to a
26 receiving coil.

1 Motivation to Combine References is Lacking

2 Applicants note that there must be some suggestion or motivation in the references cited that
3 would lead one of ordinary skill to combine the teachings of the references to achieve the invention
4 defined by a claim that is rejected as obvious in view of the references. However, it is apparent that
5 one of ordinary skill would not be led to combine Summers and Shirai. In regard to this rejection,
6 there is no motivation that would compel one of ordinary skill in the art to combine the references in
7 the manner suggested by the Examiner. Neither reference appears to provide any motivation to
8 change the coil-based inductive coupling scheme disclosed by Shirai to a coupling scheme using a
9 rotating magnet. While rotating magnets clearly are known for producing current in a coil, there is no
10 teaching or suggestion in the art of record that would provide the required motivation necessary to
11 lead one of ordinary skill in this art to replace a circuit using inductive coupling with a system that
12 induces current by employing a rotating magnetic field. Summers actually discloses both inductive
13 coupling between two coils and coupling between a coil and a rotating magnet, but offers no
14 guidance to conclude that the rotating magnet to induce current to flow in a coil would be better than
15 inductive coupling between coils. Neither Summers nor Shirai includes disclosure suggesting that
16 the coil-based inductive coupling has any disadvantages, or that the rotating magnet and coil system
17 has any advantages, such that one of ordinary skill would be led to change a functioning coil-based
18 inductive coupling system as disclosed by Shirai to use a rotating magnet to induce current in a coil.
19 The cited art simply provides no motivation to make the suggested modification of Shirai.

20 In creating the present invention, applicants determined that coil-based inductive coupling
21 systems are less efficient than a rotating magnet that induces current in a coil. This point is not
22 taught in any of the cited art. While at first blush, systems that use two inductively coupled coils
23 may seem attractive, because coupling a first coil in a base unit to a second coil in a portable
24 device to energize the portable device appears not to require any moving parts, applicants found
25 that coil-based inductive coupling actually generates significant waste heat. The transmitting coil
26 often becomes sufficiently hot, so that one or more cooling fans are required in the transmitting

1 coil housing. Applicants concluded that a motor could be used to drive a rotating magnet or flux
2 shunt, instead of a fan, and that less current for energizing the motor would be required to
3 transfer the same amount of power to a receiving coil. None of the prior art cited discusses the
4 drawbacks of inductively coupling two coils and therefore cannot provide a motivating factor that
5 would lead one of ordinary skill to the modification of Shirai in view of Summers as suggested
6 by the Examiner.

7 In an Advisory Action prepared by the Examiner in conjunction with the '700 application, the
8 Examiner asserted that Summers provided the requisite motivation, citing column 2, lines 17-19, and
9 column 5, lines 46-47 and 55-58. Those sections are reproduced below:

10 These and other objects of the invention are achieved by providing a signaling
11 system including a sensor responsive to an internal condition and connected to
12 a signaling means located near the surface of the body so that an indication of a
13 change in condition produced by the signaling means will be transmitted
14 through the skin and sensed externally and which also includes a source of
15 energy which may be either implanted or external to the body. (Column 2,
16 lines 11-18)

17 It should be understood that various combinations of the apparatus illustrated
18 in these figures may be made. Thus, a source of energy may be internal or
19 external. If internal, it may include a battery, fuel cell, or a radioactive isotope
20 fueled source from which electrical energy may be derived by heat or direct
21 conversion. If external, it may comprise an inductive or radiative generator,
22 means coupling energy into the circuit or a source of light. Any one of these
23 may be combined with any type of sensor and with any type of signal means
24 using audible, visual, or heat producing indications or be of the binary or
25 analogue variety. Alternatively, a mechanical source of energy such as a
26 wound spring can be provided to actuate an audible device. (Column 5,
lines 41-53)

FIGS. 9, 10, and 11 illustrate schematically various embodiments of the
invention. In FIG. 9, the source of energy includes a rotatable magnet 32
selected to have a strength such that when it is rotated in proximity to the
coil 34 a current will flow in the coil. (Column 5, lines 54-58)

While the above quoted selections of Summers disclose that either a rotating magnet or an
external coil can inductively couple with a coil implanted beneath a patient's skin, Summers does not
suggest that either the rotating magnet or external coil offers any advantage over the other. Summers

1 merely discloses alternative means for achieving similar results, without providing *any* disclosure
2 that would prompt one to select one means over another.

3 What is missing in any art cited by the Examiner is any motivation to combine the teachings
4 of the references, which would involve a substantial amount of modification of Summers. Clearly,
5 applicants' motivation was their discovery of a way to reduce waste heat generated by coil-based
6 inductive coupling, and to thereby increase efficiency. While increasing efficiency is arguably
7 sufficient motivation, the motivation does not exist without the discovery that the rotating magnet
8 offers a more efficient means for coupling energy into a coil than the use of a transmitting coil.
9 There is no basis to conclude that one of ordinary skill in the art at the time of the invention, given
10 the teach of the prior art cited, would have *recognized* that induction using a rotating magnet is
11 more efficient than inductive coupling between two coils. The art cited by the Examiner is
12 absolutely silent on that point, and offers no teaching as to why one type of coupling might be
13 preferred over another.

14 Applicants respectfully direct the Examiner's attention to MPEP 2144, which provides
15 direction concerning the rationale supporting an obviousness rejection. The following passage
16 regarding the expectation of some advantage is drawn from that section.

17 The strongest rationale for combining references is a recognition, expressly or
18 impliedly in the prior art or drawn from a convincing line of reasoning based
19 on established scientific principles or legal precedent, that some advantage or
20 expected beneficial result would have been produced by their combination. In
re Sernaker, 702 F.2d 989, 994-95, 217 USPQ 1, 5-6 (Fed. Cir. 1983).

21 No prior art cited by the Examiner indicates any such expected beneficial result deriving from
22 the modification of Shirai as taught by Summers. Summers merely discloses different types of
23 inductive coupling systems usable to transfer energy across a skin barrier, to energize an implanted
24 device. Summers does not teach that one type of system has any benefit not provided by any of the
25 other embodiments disclosed by Summers. Shirai similarly does not disclose that a rotating magnet
26 for inducing current to flow in a coil is superior to coil-based inductive coupling. In fact, the *only*

1 different embodiments offered by Shirai deal with coil-to-coil induction, so nothing in Shirai
2 provides any indication of an expected benefit from using a rotating magnet. Further, there is no
3 indication that at the time of the invention, it was readily known that such a beneficial result
4 (reducing heat and increasing efficiency) would derive in changing from a coil-to-coil based
5 inductive coupling system to use of a rotating magnet to induce current flow in a coil.

6 While it is true that if the art provides a different motivation (i.e. an expectation of a different
7 beneficial result), then it does not matter if the motivation is different than applicants'; however, in
8 the instant case, there is no basis that *any* beneficial result would have been expected in switching
9 one type of inductive coupling (coil to coil) with another (rotating magnet to coil).

10 As noted in MPEP 2143.01, the mere fact that references can be combined or modified does
11 not render the resultant combination obvious unless the prior art also suggests the desirability of the
12 combination (In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)). Summers simply
13 discloses that the two different types of inductive coupling can be used to transfer energy across a
14 skin barrier. Nothing cited by the Examiner indicates why it would be desirable to replace the coil-
15 to-coil inductive coupling system of Shirai with the rotating magnet-to-coil inductive coupling
16 system used by applicants' claimed invention.

17 Because the art does not indicate any basis for expecting a beneficial or desirable result from
18 combining the references as suggested by the Examiner, the combination of Shirai and Summers
19 should not be applied in rejecting the claims of the present application.

20 Combination of References Improperly Changes Shirai's Principle of Operation

21 MPEP 2143.01 clearly points out that a proposed modification in a 35 U.S.C. § 103 rejection
22 cannot change the principle of operation of a cited reference.

23 If the proposed modification or combination of the prior art would change the
24 principle of operation of the prior art invention being modified, then the
25 teachings of the references are not sufficient to render the claims prima facie
26 obvious. In re Ratti, 270 F.2d 810, 123 USPQ 349 (CCPA 1959) (Claims were
directed to an oil seal comprising a bore engaging portion with outwardly
biased resilient spring fingers inserted in a resilient sealing member. The

1 primary reference relied upon in a rejection based on a combination of
2 references disclosed an oil seal wherein the bore engaging portion was
3 reinforced by a cylindrical sheet metal casing. Patentee taught the device
4 required rigidity for operation, whereas the claimed invention required
5 resiliency. The court reversed the rejection holding the "suggested
6 combination of references would require a substantial reconstruction and
7 redesign of the elements shown in [the primary reference] as well as a change
8 in the basic principle under which the [primary reference] construction was
9 designed to operate." 270 F.2d at 813, 123 USPQ at 352

10 Summers discloses systems and methods for transferring energy across a skin layer. These
11 systems employ a variety of different principles of operation, including a radio frequency transmitter
12 coupled to an implanted coil (FIG. 6), light energy coupling to a photovoltaic cell (FIG. 7), a rotating
13 magnet (with absolutely no teaching regarding the means employed for rotating the magnet) coupling
14 to an implanted coil (FIG. 9), and an external coil coupling to an internal coil (FIG. 11) Summers
15 also discloses non rechargeable implanted energy sources, such as fuel cells and radioisotopes (see
16 column 5, lines 43-45). Thus Summers discloses several different principles of operation for
17 energizing an implanted device, including rechargeable and non-rechargeable embodiments,
18 inductive and non inductive embodiments, and even distinctly different types of inductive coupling.

19 The Examiner's suggested modification changes the operating principle of Shirai from a coil-
20 to-coil form of inductive coupling to a rotating magnet-to-coil based form of inductive coupling. Just
21 as the oil seals noted above in the MPEP reference are distinguishable, coil and rotating magnet
22 produced coupling are distinguishable. There is no more basis for asserting that coil-to-coil based
23 inductive coupling is the same operating principle as rotating magnet-to-coil based inductive
24 coupling, than there is to assert that the oils seals noted in the case referenced in the MPEP reference
25 cited above represent the same operating principle. While at an extremely high level, all oil seals and
26 all forms of inductive coupling share similarities, it appears that the Examiner has not looked closely
enough at the distinguishable operating principles to the degree that MPEP 2143.01 requires.

Because combining Shirai and Summers in the manner suggested by the Examiner improperly
changes the principle of operation in Shirai from only a coil-to-coil based system of energy transfer

1 to a distinctly different rotating magnet-to-coil based system of energy transfer, the combination of
2 Shirai and Summers should not be applied to the claims of the present invention

3 Combination of References Are Too Disparate

4 Applicants respectfully submit that the references cited by the Examiner, Summers and Shirai,
5 are too unrelated for such a combination to be proper. Summers and Shirai are not so analogous that
6 an artisan of ordinary skill would have considered combining the teachings of these references, to
7 achieve the combination claimed by applicants, as suggested by the Examiner. Note that Summers
8 and Shirai share no commonality with respect to their classification, or the field of search. While
9 such evidence does have some weight in determining whether prior art is analogous, the actual
10 teachings of each piece of prior art are more dispositive. With respect to analogy in conjunction with
11 electrical arts, a case cited in the MPEP (2141.01a), *Wang Laboratories, Incorp. v. Toshiba Corp.*
12 holds that a memory module in a personal computer and a memory module in an industrial controller
13 were not necessarily analogous. Summers is directed to a medical device implanted in a patient that
14 provides bio-data monitoring, and Shirai is directed to a contactless energy transfer system used
15 outside a patient's body. Clearly, Summers and Shirai are more disparate than personal computers
16 and industrial controllers, and under the logic referred to in *Wang*, the combination of Summers and
17 Shirai is an improper basis for a rejection of applicants' claims. Note that the driving consideration
18 for transferring energy across a dermal layer in Summers (to avoid invasive surgery that might
19 otherwise be required to recharge an implanted device) is completely lacking in Shirai or in the
20 present invention. Because combining Shirai and Summers in the manner suggested by the
21 Examiner improperly combines non analogous art, the combination of Shirai and Summers should
22 not be applied in rejecting the claims of the present application

23 Claims Rejected under 35 U.S.C. § 103(a) over Poumey/Rohde in view of Summers

24 During the prosecution of the '700 parent application, the Examiner rejected Claims 24, 27,
25 28, 33, 34, 36, 37, 41, 42, and 50-53 under 35 U.S.C. § 103(a) as being unpatentable over Poumey
26 (U.S. Patent No. 5,710,502) in combination with Summers. Poumey teaches a system for recharging

1 the storage batteries of an electric motor vehicle, the system including a stationary unit with a
2 generator and primary coil inductively coupled to a vehicle-mounted unit with a secondary coil. The
3 Examiner states that Poumey does not teach a flux generator comprising a driven permanent magnet
4 inductively coupled to a receiver coil. The Examiner relies instead on Summers for disclosing a
5 driven permanent magnet. The Examiner concludes that it would have been obvious to one having
6 ordinary skill in the art at the time of the invention to modify Poumey and provide a driven magnet
7 per Summers for the flux generator for the purpose of inducing current within a contactless secondary
8 coil.

9 Also in the '700 application, the Examiner additionally rejected Claims 33-37, 39, 41-44, 54,
10 and 55 under 35 U.S.C. § 103(a) as being unpatentable over Rohde (U.S. Patent No. 5,959,433) in
11 view of Summers (U.S. Patent No. 3,672,352) and common knowledge. The Examiner indicates that
12 Rohde teaches a system for inductive, contactless recharging of batteries including: a receiver pick
13 up coil 16 in a portable battery pack 14; a flux generator comprising a charging coil 44 disposed in a
14 base component 12; and, a conditioner circuit including rectifier 18, which produces a conditioned
15 voltage V2 for charging battery 22. As in the rejections based on Poumey, the Examiner indicates
16 that Rohde does not teach a flux generator comprising a driven permanent magnet inductively
17 coupled to the receiver coil 16. However, the Examiner again relies on Summers as described above,
18 for disclosing a driven permanent magnet. The Examiner concludes that it would have been obvious
19 to one having ordinary skill in the art at the time of applicants' invention to modify Rohde and
20 provide a driven magnet per Summers, for the flux generator, for the purpose of inducing current
21 within a contactless secondary coil.

22 Applicants respectfully submit that for the same reasons provided above with respect to the
23 combination of Summer and Shirai, the combinations of Summers/Poumey and Summers/Rohde do not
24 represent valid combinations of references. There is no suggestion in the prior art that any benefit could
25 be expected by replacing the coil-to-coil inductive coupling of Poumey with a rotating magnet-to-coil
26 inductive coupling system described in Summers. The mere fact that Summers discloses a rotating

1 magnet-to-coil inductive coupling system does not justify the conclusion there would be any expected
2 benefit to combine or modify the references in the manner suggested by the Examiner. With respect to
3 Rohde, again there is no suggestion of any particular benefit that would be expected, tending to motivate
4 one of ordinary skill in the art to combine the references as suggested by the Examiner. The art cited
5 simply provides no expectation of any benefit and is silent as to why any increase in efficiency might
6 occur, and thus asserting that an increase in efficiency provides the requisite motivation is not justified.
7 Applicants recognized that a reduction in heat losses would result in efficiency gains even though energy
8 would be required to rotate (or otherwise move) a magnet or flux shunt in their invention. There is no
9 support in the art of record indicating that anyone of ordinary skill in the art at the time of the invention
10 would have expect such a benefit.

11 Like Shirai, Poumey and Rohde only disclose embodiments that employ coil-to-coil inductive
12 coupling. Applicants pointed this out to the Examiner in a prior response to an Office action in the parent
13 application, and the Examiner disregarded this argument as applicants' "own spin," and asserted that since
14 Summers disclosed various energy transmittal methods, including coil-to-coil inductive coupling and
15 rotating magnet-to-coil inductive coupling systems, it was irrelevant that the Shirai, Poumey, and Rohed
16 only disclosed a coil-to-coil type of inductive coupling. Applicants respectfully rely on the arguments
17 discussed above to traverse this prospective rejection. There must be an expected benefit to provide
18 motivation for a combination, and the combination cannot change the principle of operation of a reference.
19 These principles are not applicants' "own spin," but instead are based upon policies and procedures set forth
20 in the MPEP. Because Poumey and Rohde only disclose coil-to-coil inductive coupling, it is not
21 appropriate to change the principle of operation of those references (by combining with *any* references that
22 change the principle of operation) to achieve a device that employs a rotating magnet-to-coil inductive
23 coupling. The two types of inductive coupling techniques (coil and magnet) employ different principles of
24 operation. The above cited section of the MPEP shows that two types of oil seals having different principles
25 of operation should not be cited in rejecting claims, and there is no basis to conclude that two different types
26 of inductive coupling techniques should be viewed with a different standard.

1 Finally, as discussed above, the art to be combined must be sufficiently analogous. Poumey
2 and Rohde are no more analogous to Summers than Shirai is (or than a memory module in a personal
3 computer is to a memory module in an industrial controller are (see *Wang, supra*)). Therefore, one
4 skilled in the art would not be motivated to combine Poumey with Summers, or Rohde with Summers.

5 Because combining Poumey/Summers or Rohde/Summers in the manner suggested by the
6 Examiner improperly changes the principle of operation in Poumey and Rohde from a coil-to-coil
7 based system of energy transfer to a distinctly different rotating magnet-to-coil based system of
8 energy transfer, because combining Poumey/Summers or Rohde/Summers in the manner suggested
9 by the Examiner improperly combines non analogous art, and because combining Poumey/Summers
10 or Rohde/Summers in the manner suggested by the Examiner is not supported by any expectation of a
11 beneficial result that would provide motivation for making such a combination, the combinations of
12 Poumey/Summers or Rohde/Summers should not be applied in rejecting the claims of the present
13 application.

14 In consideration of the preceding remarks, it will be apparent that all claims in this application
15 are patentable as submitted. The Examiner is therefore requested to pass this application to Issue
16 without delay. In the event that any questions remain unresolved, the Examiner is invited to
17 telephone applicants' attorney at the number listed below.

18 Respectfully submitted,

19 

20 Ronald M. Anderson
21 Registration No. 28,829

22 EXPRESS MAIL CERTIFICATE

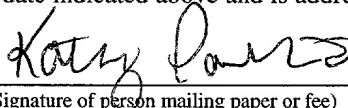
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